Synthetic type III radio bursts and energetic electron diffusion by whistler waves in the solar wind

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Abstract:

In observed solar wind electron velocity distribution functions (VDFs), different populations can be distinguished: A thermal core, an anisotropic halo, and an isotropic superhalo. The presence of isotropic distributions of supra-thermal electrons indicates that some diffusion mechanism must exist in interplanetary space, since the expanding magnetic field geometry of the Parker spiral otherwise would focus the electrons into an extremely narrow beam. A kinetic model is presented that is based on resonant interaction between electrons and whistler waves. The primary effect of the waves on the electrons is pitch-angle diffusion in the reference frame of the waves. This model is used to study the generation of supra-thermal electrons in the solar corona and wind, but it provides also an ideal testbed for the propagation of solar flare-generated energetic electrons in the heliosphere. The results of such a solar flare study are presented, and a method is derived to estimate the associated type III radio emission. Dynamic radio spectra, as they would be recorded by a distant observer, are shown, and the use of STEREO/SWAVES data for constraining the model will be discussed.